FUEL CELL GENERATION FACILITIES

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Inventor: TODA MASAKI; MINEO TOKUICHI; OGAWA MASAKI
Applicant: MITSUBISHI HEAVY IND LTD
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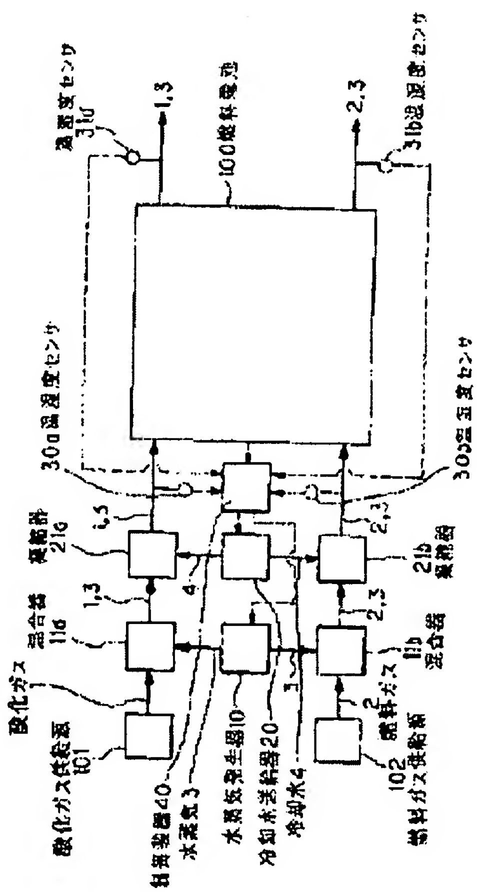
Abstract of **JP2002313381**

PROBLEM TO BE SOLVED: To provide fuel cell generation facilities capable of suppressing the production of excessive water while sufficiently humidifying a solid polymer electrolyte at all times. SOLUTION: The fuel cell generation facilities comprise a fuel cell 100 having a stack with cells and separators stacked alternately, a steam generator 10 and mixture 11a, 11b for mixing an air 1 and a hydrogen 2 supplied from an air supply source 101 and a hydrogen supply source 102, respectively, with a steam 3, a cooling water feeder 20 and condensers 21a, 21b for cooling the air 1 and the hydrogen 2 mixed with the steam 3 to control a water content in the air 1 and the hydrogen 2, and control means 40 for controlling the steam generator 10 and the cooling water feeder 20 in accordance with a loaded condition signal from the fuel cell 100 an signals from temperature and humidity sensors 30a, 30b, 31a, 31b.



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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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CLAIMS

[Claim(s)]
[Claim 1] The fuel cell with which the cel and the separator were equipped with the stack by which two or more laminatings were carried out by turns, An oxidation gas supply means to supply oxidation gas to said fuel cell, and a fuel gas supply means to supply fuel gas to said fuel cell, the oxidation gas which mixes a steam in said oxidation gas supplied from said oxidation gas supply means -- service water -- with a steamy mixing means the fuel gas which mixes a steam to said fuel gas supplied from said fuel gas supply means -- service water -- with a steamy mixing means based on the signal of the loaded condition from said fuel cell, the amount of the steam mixed to said oxidation gas and said fuel gas is adjusted -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- the fuel cell generation-of-electrical-energy facility characterized by having the control means which controls a steamy mixing means.
[Claim 2] Said cooling means for fuel gas is controlled to increase the amount of the steam mixed to said fuel gas while said control means controls said cooling means for oxidation gas in claim 1 to reduce the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is large. The fuel cell generation-of-electrical-energy facility characterized by controlling said cooling means for fuel gas to reduce the amount of the steam mixed to said fuel gas while controlling said cooling means for oxidation gas to increase the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is small.
[Claim 3] A cooling means for oxidation gas to adjust the moisture in the oxidation gas concerned by cooling said oxidation gas which had said steam mixed in claims 1 or 2, It has a cooling means for fuel gas to adjust the moisture in the fuel gas concerned by cooling said fuel gas which had said steam mixed. The fuel cell generation-of-electrical-energy facility characterized by said control means controlling said cooling means for oxidation gas, and said cooling means for fuel gas based on the signal of the loaded condition from said fuel cell to cool said oxidation gas and said fuel gas.
[Claim 4] The fuel cell generation-of-electrical-energy facility characterized by for said control means controlling said cooling means for oxidation gas to cool said oxidation gas when the load of said fuel cell is large, and controlling said cooling means for fuel gas in claim 3 to cool said fuel gas when the load of said fuel cell is small.

[Claim 5] A temperature-and-humidity measurement means for supply oxidation gas to measure the temperature and humidity of said oxidation gas which are supplied to said fuel cell in claims 3 or 4, It has a temperature-and-humidity measurement means for supply fuel gas to measure the temperature and humidity of said fuel gas which are supplied to said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for supply oxidation gas, and said temperature-and-humidity measurement means for supply fuel gas. said oxidation gas and said fuel gas are made into predetermined temperature and humidity -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- the fuel cell generation-of-electrical-energy facility characterized by controlling a steamy mixing means, said cooling means for oxidation gas, and said cooling means for fuel gas, respectively.
[Claim 6] A temperature-and-humidity measurement means for discharge oxidation gas to measure the temperature and humidity of said oxidation gas which were discharged from said fuel cell in claim 5, It has a temperature-and-humidity measurement means for discharge fuel gas to measure the temperature and humidity of said fuel gas which were discharged from said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for discharge oxidation gas, and said temperature-and-humidity measurement means for discharge fuel gas. So that said oxidation gas by which it is discharged from said fuel cell, and said fuel gas may be made into predetermined temperature and humidity Said cooling means for oxidation gas, said cooling means for fuel gas, and said oxidization gas -- service water -- a steamy mixing means and said fuel gas -- service water -- the fuel cell generation-of-electrical-energy facility characterized by carrying out feedback control of the steamy mixing means, respectively.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a fuel cell generation-of-electrical-energy facility.
[0002]
[Description of the Prior Art] If the cel which sandwiched the solid-state polyelectrolyte on the oxidation gas pole and the fuel gas pole, and a separator are equipped with the stack by which two or more laminatings were carried out by turns and oxidation gas and fuel gas are fed in the stack concerned, a solid-state polyelectrolyte mold fuel cell The oxidation gas pole of each cel is supplied from the oxidation gas-passageway slot where oxidation gas was formed in one field of each separator. Power is obtained, when the fuel gas pole of each cel is supplied and the oxidation gas (oxygen) concerned and fuel gas (hydrogen) react electrochemically in a cel from the fuel gas passage slot where fuel gas was formed in the field of another side of each separator.
[0003] In such a fuel cell, in order for the solid-state polyelectrolyte of each cel in a stack to enable migration of a hydrogen ion in the case of a generation of electrical energy, it is necessary to fully carry out humidity. For this reason, as shown in drawing 4 , the steam generator 110 is connected to oxidation gas supply opening and the fuel gas feed hopper of a fuel cell 100 through Mixers 111a and 111b. By mixing the steam 3 generated by the steam generator 110 to oxidation gas 1 and fuel gas 2 with Mixers 111a and 111b, and supplying a steam 3 in a fuel cell 100 with oxidation gas 1 and fuel gas 2, respectively He is trying to supply moisture to the solid-state polyelectrolyte of each cel in a stack. That is, he is trying to use the oxidation gas 1 and fuel gas 2 which are used as a raw material of a generation of electrical energy as carrier gas of a steam 3.
[0004]
[Problem(s) to be Solved by the Invention] In the fuel cell 100 which was mentioned above, while moisture moves to an oxidation gas pole side from a fuel gas pole side with migration of the hydrogen ion in the solid-state polyelectrolyte of the cel in a stack, water generates to an oxidation gas pole side with the reaction of the oxidation gas (oxygen) 1 by the side of the oxidation gas pole of a cel, and the above-mentioned hydrogen ion. Thus, although the moisture which moves to an oxidation gas pole side, and the moisture generated with the reaction

will be used for humidification of a solid-state polyelectrolyte with the steam 3 mentioned above when the load of a fuel cell 100 is small (at the time of low loading), when the load of a fuel cell 100 is large (at the time of a heavy load), its amount of the will increase sharply and the amount of surplus will condense it by oxidation gas-passageway Mizouchi of a separator. Thus, if water condenses by oxidation gas-passageway Mizouchi of a separator, smooth circulation of oxidation gas 1 will be barred, the short supply of oxidation gas 1 will be caused, and a possibility of causing the fall of generation-of-electrical-energy capacity will be produced.

[0005] Since it is such, this invention aims at offering the fuel cell generation-of-electrical-energy facility which can suppress generating of redundant water, though a solid-state polyelectrolyte is always fully humidified.

[0006]

[Means for Solving the Problem] The fuel cell generation-of-electrical-energy facility by the first invention for solving the technical problem mentioned above The fuel cell with which the cel and the separator were equipped with the stack by which two or more laminatings were carried out by turns, An oxidation gas supply means to supply oxidation gas to said fuel cell, and a fuel gas supply means to supply fuel gas to said fuel cell, the oxidation gas which mixes a steam in said oxidation gas supplied from said oxidation gas supply means -- service water -- with a steamy mixing means the fuel gas which mixes a steam to said fuel gas supplied from said fuel gas supply means -- service water -- with a steamy mixing means based on the signal of the loaded condition from said fuel cell, the amount of the steam mixed to said oxidation gas and said fuel gas is adjusted -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by having the control means which controls a steamy mixing means.

[0007] The fuel cell generation-of-electrical-energy facility by the second invention is set to the first invention. Said cooling means for fuel gas is controlled to increase the amount of the steam mixed to said fuel gas while said control means controls said cooling means for oxidation gas to reduce the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is large. When the load of said fuel cell is small, while controlling said cooling means for oxidation gas to increase the amount of the steam mixed in said oxidation gas, it is characterized by controlling said cooling means for fuel gas to reduce the amount of the steam mixed to said fuel gas.

[0008] The fuel cell generation-of-electrical-energy facility by the third invention is set to the first or the second invention. A cooling means for oxidation gas to adjust the moisture in the oxidation gas concerned by cooling said oxidation gas which had said steam mixed, It has a cooling means for fuel gas to adjust the moisture in the fuel gas concerned by cooling said fuel gas which had said steam mixed. Said control means is characterized by controlling said cooling means for oxidation gas, and said cooling means for fuel gas based on the signal of the loaded condition from said fuel cell to cool said oxidation gas and said fuel gas.

[0009] As for the fuel cell generation-of-electrical-energy facility by the fourth invention, it is characterized by for said control means controlling said cooling

means for oxidation gas to cool said oxidation gas, when the load of said fuel cell is large, and controlling said cooling means for fuel gas in the third invention, to cool said fuel gas, when the load of said fuel cell is small.

[0010] The fuel cell generation-of-electrical-energy facility by the fifth invention is set to the third or the fourth invention. A temperature-and-humidity measurement means for supply oxidation gas to measure the temperature and humidity of said oxidation gas which are supplied to said fuel cell, It has a temperature-and-humidity measurement means for supply fuel gas to measure the temperature and humidity of said fuel gas which are supplied to said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for supply oxidation gas, and said temperature-and-humidity measurement means for supply fuel gas. said oxidation gas and said fuel gas are made into predetermined temperature and humidity -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by controlling a steamy mixing means, said cooling means for oxidation gas, and said cooling means for fuel gas, respectively.

[0011] The fuel cell generation-of-electrical-energy facility by the sixth invention is set to the fifth invention. A temperature-and-humidity measurement means for discharge oxidation gas to measure the temperature and humidity of said oxidation gas which were discharged from said fuel cell, It has a temperature-and-humidity measurement means for discharge fuel gas to measure the temperature and humidity of said fuel gas which were discharged from said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for discharge oxidation gas, and said temperature-and-humidity measurement means for discharge fuel gas. So that said oxidation gas by which it is discharged from said fuel cell, and said fuel gas may be made into predetermined temperature and humidity Said cooling means for oxidation gas, said cooling means for fuel gas, and said oxidization gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by carrying out feedback control of the steamy mixing means, respectively.

[0012]

[Embodiment of the Invention] The gestalt of implementation of the fuel cell generation-of-electrical-energy facility by this invention is explained using drawing 1 . Drawing 1 is the outline block diagram of a fuel cell generation-of-electrical-energy facility. In addition, this invention is not limited to the gestalt of the following operations.

[0013] As shown in drawing 1 , the sources 101 of oxidation gas supply (for example, air compressor etc.) which are oxidation gas supply means to supply oxidation gas 1, such as air and oxygen, are connected to oxidation gas supply opening of the fuel cell 100 with which the cel which sandwiched the solid-state polyelectrolyte on the oxidation gas pole and the fuel gas pole, and the separator were equipped with the stack by which two or more laminatings were carried out by turns. The fuel gas sources of supply (for example, methanol-reforming machine etc.) 102 which are fuel gas supply means to supply fuel gas 2, such as hydrogen gas, are connected to the fuel gas feed hopper of a fuel cell 100.

[0014] Between said sources 101 of oxidation gas supply and said oxidation gas

supply openings of a fuel cell 100, the steam generator 10 made to generate a steam 3 is connected through mixer 11a. Between said fuel gas sources of supply 102 and said fuel gas feed hoppers of a fuel cell 100, the above-mentioned steam generator 10 is connected through mixer 11b. Between said mixer 11a and said oxidation gas supply openings of a fuel cell 100, the cooling water feeding machine 20 which feeds cooling water 4 is connected through condenser 21a. Between said mixer 11b and said fuel gas feed hoppers of a fuel cell 100, the above-mentioned cooling water feeding machine 20 is connected through condenser 21b.
[0015] in addition -- the gestalt of this operation -- the steam generator 10, mixer 11a, etc. -- oxidation gas -- service water -- a steamy mixing means -- constituting -- the steam generator 10, mixer 11b, etc. -- fuel gas -- service water -- a steamy mixing means is constituted, the cooling water feeding machine 20, condenser 21a, etc. constitute the cooling means for oxidation gas, and the cooling water feeding machine 20, condenser 21b, etc. constitute the cooling means for fuel gas.
[0016] Said steam generator 10 and said cooling water feeding machine 20 are electrically connected to the output section of the control unit 40 which is a control means, respectively. On the other hand, between said condenser 21a and said oxidation gas supply openings of a fuel cell 100, temperature-and-humidity sensor 30a which is a temperature-and-humidity measurement means for supply oxidation gas to detect temperature and humidity is prepared. Between said condenser 21b and said fuel gas feed hoppers of a fuel cell 100, temperature-and-humidity sensor 30b which is a temperature-and-humidity measurement means for supply fuel gas to detect temperature and humidity is prepared. Near the oxidation gas exhaust of a fuel cell 100, temperature-and-humidity sensor 31a which is a temperature-and-humidity measurement means for discharge oxidation gas to detect temperature and humidity is prepared. Near the fuel gas exhaust port of a fuel cell 100, temperature-and-humidity sensor 31b which is a temperature-and-humidity measurement means for discharge fuel gas to detect temperature and humidity is prepared. These temperature-and-humidity sensors 30a, 30b, 31a, and 31b are electrically connected to the input section of the above-mentioned control unit 40, respectively. Moreover, the signal of loaded condition is inputted into the input section of the above-mentioned control unit 40 from a fuel cell 100.
[0017] Thus, it sets to the generation-of-electrical-energy facility constituted. While the oxidation gas 1 fed from the source 101 of oxidation gas supply is supplied to oxidation gas supply opening of a fuel cell 100 If the fuel gas 2 fed from the fuel gas source of supply 102 is supplied to the fuel gas feed hopper of a fuel cell 100 The oxidation gas pole of each cel is supplied from the oxidation gas-passageway slot where oxidation gas 1 was formed in one field of each separator of a stack. The fuel gas pole of each cel is supplied from the fuel gas passage slot where fuel gas 2 was formed in the field of another side of each separator of a stack, the oxidation gas (oxygen) concerned and fuel gas (hydrogen) react electrochemically in a cel from it, and a generation of electrical energy is performed.
[0018] In order to fully carry out humidity of the solid-state polyelectrolyte of each cel in the stack of a fuel cell 100 at this time, By generating a steam 3 by the

steam generator 10, and feeding in mixer 11a and 11b A steam 3 is mixed to oxidation gas 1 and fuel gas 2, and moisture is supplied to the solid-state polyelectrolyte of each cel in a stack by supplying a steam 3 in the stack of a fuel cell 100 with oxidation gas 1 and fuel gas 2, respectively.

[0019] Thus, if the load of a fuel cell 100 becomes large when generating electricity The amount of the moisture generated to the oxidation gas pole side accompanying the reaction of the oxidation gas (oxygen) 1 by the side of [the fuel gas pole side accompanying migration of the hydrogen ion in the solid-state polyelectrolyte of the cel in a stack to] the movement magnitude of the moisture by the side of an oxidation gas pole and the oxidation gas pole of a cel and the above-mentioned hydrogen ion increases sharply. Redundant water is produced in an oxidation gas pole side, and a possibility that the redundant water concerned may condense by oxidation gas-passageway Mizouchi of a separator, and may bar smooth circulation of oxidation gas 1 is produced.

[0020] Then, in a fuel cell generation-of-electrical-energy facility of the gestalt of this operation, said control unit 40 controls the steam generator 10 and the cooling water feeding machine 20 based on the signal of the loaded condition from a fuel cell 100, and the signal from said temperature-and-humidity sensors 30a, 30b, 31a, and 31b to fully carry out humidity of the solid-state polyelectrolyte of a cel, without making redundant water condense by oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100. The control approach by this control unit 40 is explained below using drawing 2 and 3. The graph with which drawing 2 expresses relation with the humidity of the electrical property of a fuel cell, oxidation gas, and fuel gas, and drawing 3 are the graphs showing the humidity of the oxidation gas accompanying a load effect, and fuel gas.

[0021] A fuel cell 100 has few amounts of the moisture generated to a movement magnitude [of the moisture from an above-mentioned fuel gas pole side to an oxidation gas pole side], and oxidation gas pole side at the time of the small low loading of a load, and the amount of the moisture generated to a movement magnitude [of the moisture from an above-mentioned fuel gas pole side to an oxidation gas pole side] and oxidation gas pole side at the time of the large heavy load of a load increases. As shown in drawing 2 , for this reason, at the time of the low loading of a fuel cell 100 (inside of drawing 2 , left (for example, A point)) the humidity of oxidation gas 1 -- comparatively -- many -- carrying out (80%) -- humidity of fuel gas 2 is lessened comparatively (70%) -- on the other hand at the time of the heavy load of a fuel cell 100 (inside of drawing 2 , rightist inclinations (for example, B point)) the humidity of oxidation gas 1 -- comparatively -- few -- carrying out (20%) -- humidity of fuel gas 2 is made [many / comparatively] (90%) -- ** -- by carrying out Humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100 condense redundant water.

[0022] That is, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water flow into oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100 by adjusting the humidity of oxidation gas 1 and fuel gas 2 so that it may correspond to the graph shown in drawing 2 based on the loaded condition of a fuel cell 100.

[0023] A control unit 40 is specifically based on the signal of the loaded condition of a fuel cell 100, and a signal from the temperature-and-humidity sensors 30a and 30b. While adjusting the amount of the steam 3 which controls the steam generator 10 to make it in agreement with the value of the graph which showed the humidity of the oxidation gas 1 supplied in a fuel cell 100, and fuel gas 2 to drawing 2 , and is mixed to oxidation gas 1 and fuel gas 2 Humidity of the oxidation gas 1 accompanying change of the moisture by the side of the above-mentioned oxidation gas pole produced in the cel in the stack of a fuel cell 100 and a fuel gas pole and fuel gas 2 is checked with the signal from the temperature-and-humidity sensors 31a and 31b (feedback).
[0024] When the load of a fuel cell 100 increases rapidly, here A control unit 40 controls the yield of the steam 3 from the steam generator 10 to make humidity of oxidation gas 1 low quickly, while making humidity of fuel gas 2 high quickly. When the loads of a fuel cell 100 decrease in number rapidly, a control unit 40 needs to control the yield of the steam 3 from the steam generator 10 to make humidity of fuel gas 2 low quickly while making humidity of oxidation gas 1 high quickly. Although controlled to remove a part for needlessness with Condensers 21a and 21b superfluously [amount / of the steam 3 generated from the steam generator 10], making high quickly humidity of oxidation gas 1 or fuel gas 2 by adjusting the amount of the steam 3 generated from the steam generator 10 It is very difficult to make low quickly humidity of oxidation gas 1 or fuel gas 2 only by adjusting the amount of the steam 3 generated from the steam generator 10.
[0025] for this reason, further, when the load of a fuel cell 100 increases rapidly based on the signal of the loaded condition of a fuel cell 100, a control unit 40 By controlling the cooling water feeding machine 20 to make cooling water 4 spray into condenser 21a from the cooling water feeding machine 20 Oxidation gas 1 is cooled quickly, condensation removal of the moisture in the oxidation gas 1 concerned is carried out, and it is made quickly in agreement with the value of the graph which showed the humidity of the oxidation gas 1 supplied in a fuel cell 100 to drawing 2 . When the loads of a fuel cell 100 decrease in number rapidly like this, fuel gas 2 is quickly cooled by controlling the cooling water feeding machine 20, condensation removal of the moisture in the fuel gas 2 concerned is carried out so that cooling water 4 may be made to spray into condenser 21b, and it is made quickly in agreement with the value of the graph which showed the humidity of the fuel gas 2 supplied in a fuel cell 100 to drawing 2 .
[0026] Although both oxidation gas 1 and fuel gas 2 always had conventionally fixed humidity as shown in drawing 3 , by this with the gestalt of this operation When the load of a fuel cell 100 increases rapidly When the humidity of fuel gas 2 goes up with sufficient responsibility and the loads of a fuel cell 100 decrease in number rapidly at the same time it follows this and the humidity of oxidation gas 1 falls with sufficient responsibility This is followed, and the humidity of fuel gas 2 comes to fall with sufficient responsibility at the same time the humidity of oxidation gas 1 goes up with sufficient responsibility.
[0027] Therefore, according to the gestalt of this operation, though the solid-state polyelectrolyte of the cel in a stack is always fully humidified, generating of redundant water can be suppressed.

[0028]
[Effect of the Invention] The fuel cell with which the fuel cell generation-of-electrical-energy facility by the first invention was equipped with the stack to which two or more laminatings of a cel and the separator were carried out by turns, An oxidation gas supply means to supply oxidation gas to said fuel cell, and a fuel gas supply means to supply fuel gas to said fuel cell, the oxidation gas which mixes a steam in said oxidation gas supplied from said oxidation gas supply means -- service water -- with a steamy mixing means the fuel gas which mixes a steam to said fuel gas supplied from said fuel gas supply means -- service water -- with a steamy mixing means based on the signal of the loaded condition from said fuel cell, the amount of the steam mixed to said oxidation gas and said fuel gas is adjusted -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- from having had the control means which controls a steamy mixing means a control means -- the signal of the loaded condition from a fuel cell -- being based -- oxidation gas -- service water -- a steamy mixing means and fuel gas -- service water, since the amount of the steam which controls a steamy mixing means and is mixed to oxidation gas and said fuel gas is adjusted Even if it changes the load of a fuel cell, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water condense by passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas.
[0029] The fuel cell generation-of-electrical-energy facility by the second invention is set to the first invention. Said cooling means for fuel gas is controlled to increase the amount of the steam mixed to said fuel gas while said control means controls said cooling means for oxidation gas to reduce the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is large. Since said cooling means for fuel gas is controlled to reduce the amount of the steam mixed to said fuel gas while controlling said cooling means for oxidation gas to increase the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is small Even if it changes the load of a fuel cell, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water condense by passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas.
[0030] The fuel cell generation-of-electrical-energy facility by the third invention is set to the first or the second invention. A cooling means for oxidation gas to adjust the moisture in the oxidation gas concerned by cooling said oxidation gas which had said steam mixed, It has a cooling means for fuel gas to adjust the moisture in the fuel gas concerned by cooling said fuel gas which had said steam mixed. Since said control means controls said cooling means for oxidation gas, and said cooling means for fuel gas based on the signal of the loaded condition from said fuel cell to cool said oxidation gas and said fuel gas Even if it changes the load of a fuel cell rapidly, this can be followed and the humidity of oxidation gas and fuel gas can be adjusted.
[0031] The fuel cell generation-of-electrical-energy facility by the fourth invention is set to the third invention. Said cooling means for oxidation gas is controlled so that said control means cools said oxidation gas, when the load of said fuel cell is

large. Since said cooling means for fuel gas is controlled to cool said fuel gas when the load of said fuel cell is small, even if it changes the load of a fuel cell rapidly, this can be followed and the humidity of oxidation gas and fuel gas can be adjusted.

[0032] The fuel cell generation-of-electrical-energy facility by the fifth invention is set to the third or the fourth invention. A temperature-and-humidity measurement means for supply oxidation gas to measure the temperature and humidity of said oxidation gas which are supplied to said fuel cell, It has a temperature-and-humidity measurement means for supply fuel gas to measure the temperature and humidity of said fuel gas which are supplied to said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for supply oxidation gas, and said temperature-and-humidity measurement means for supply fuel gas. said oxidation gas and said fuel gas are made into predetermined temperature and humidity -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water, since a steamy mixing means, said cooling means for oxidation gas, and said cooling means for fuel gas are controlled, respectively Oxidation gas and fuel gas can be adjusted to the temperature and humidity corresponding to the load of a fuel cell, without being influenced by the original temperature and humidity of oxidation gas and fuel gas.
[0033] The fuel cell generation-of-electrical-energy facility by the sixth invention is set to the fifth invention. A temperature-and-humidity measurement means for discharge oxidation gas to measure the temperature and humidity of said oxidation gas which were discharged from said fuel cell, It has a temperature-and-humidity measurement means for discharge fuel gas to measure the temperature and humidity of said fuel gas which were discharged from said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for discharge oxidation gas, and said temperature-and-humidity measurement means for discharge fuel gas. So that said oxidation gas by which it is discharged from said fuel cell, and said fuel gas may be made into predetermined temperature and humidity Said cooling means for oxidation gas, said cooling means for fuel gas, and said oxidization gas -- service water -- a steamy mixing means and said fuel gas -- service water, since feedback control of the steamy mixing means is carried out, respectively The humidity of oxidation gas and fuel gas can be adjusted checking condensation of the redundant water in passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas, and the damp or wet condition of the solid-state polyelectrolyte of a cel.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to a fuel cell generation-of-electrical-energy facility.

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PRIOR ART

[Description of the Prior Art] If the cel which sandwiched the solid-state polyelectrolyte on the oxidation gas pole and the fuel gas pole, and a separator are equipped with the stack by which two or more laminatings were carried out by turns and oxidation gas and fuel gas are fed in the stack concerned, a solid-state polyelectrolyte mold fuel cell The oxidation gas pole of each cel is supplied from the oxidation gas-passageway slot where oxidation gas was formed in one field of each separator. Power is obtained, when the fuel gas pole of each cel is supplied and the oxidation gas (oxygen) concerned and fuel gas (hydrogen) react electrochemically in a cel from the fuel gas passage slot where fuel gas was formed in the field of another side of each separator.
[0003] In such a fuel cell, in order for the solid-state polyelectrolyte of each cel in a stack to enable migration of a hydrogen ion in the case of a generation of electrical energy, it is necessary to fully carry out humidity. For this reason, as shown in drawing 4 , the steam generator 110 is connected to oxidation gas supply opening and the fuel gas feed hopper of a fuel cell 100 through Mixers 111a and 111b. By mixing the steam 3 generated by the steam generator 110 to oxidation gas 1 and fuel gas 2 with Mixers 111a and 111b, and supplying a steam 3 in a fuel cell 100 with oxidation gas 1 and fuel gas 2, respectively He is trying to supply moisture to the solid-state polyelectrolyte of each cel in a stack. That is, he is trying to use the oxidation gas 1 and fuel gas 2 which are used as a raw material of a generation of electrical energy as carrier gas of a steam 3.

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EFFECT OF THE INVENTION

[Effect of the Invention] The fuel cell with which the fuel cell generation-of-electrical-energy facility by the first invention was equipped with the stack to which two or more laminatings of a cel and the separator were carried out by turns, An oxidation gas supply means to supply oxidation gas to said fuel cell, and a fuel gas supply means to supply fuel gas to said fuel cell, the oxidation gas which mixes a steam in said oxidation gas supplied from said oxidation gas supply means -- service water -- with a steamy mixing means the fuel gas which mixes a steam to said fuel gas supplied from said fuel gas supply means -- service water -- with a steamy mixing means based on the signal of the loaded condition from said fuel cell, the amount of the steam mixed to said oxidation gas and said fuel gas is adjusted -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- from having had the control means which controls a steamy mixing means a control means -- the signal of the loaded condition from a fuel cell -- being based -- oxidation gas -- service water -- a steamy mixing means and fuel gas -- service water, since the amount of the steam which controls a steamy mixing means and is mixed to oxidation gas and said fuel gas is adjusted Even if it changes the load of a fuel cell, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water condense by passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas.
[0029] The fuel cell generation-of-electrical-energy facility by the second invention is set to the first invention. Said cooling means for fuel gas is controlled to increase the amount of the steam mixed to said fuel gas while said control means controls said cooling means for oxidation gas to reduce the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is large. Since said cooling means for fuel gas is controlled to reduce the amount of the steam mixed to said fuel gas while controlling said cooling means for oxidation gas to increase the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is small Even if it changes the load of a fuel cell, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water condense by passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas.
[0030] The fuel cell generation-of-electrical-energy facility by the third invention is set to the first or the second invention. A cooling means for oxidation gas to

adjust the moisture in the oxidation gas concerned by cooling said oxidation gas which had said steam mixed, It has a cooling means for fuel gas to adjust the moisture in the fuel gas concerned by cooling said fuel gas which had said steam mixed. Since said control means controls said cooling means for oxidation gas, and said cooling means for fuel gas based on the signal of the loaded condition from said fuel cell to cool said oxidation gas and said fuel gas Even if it changes the load of a fuel cell rapidly, this can be followed and the humidity of oxidation gas and fuel gas can be adjusted.

[0031] The fuel cell generation-of-electrical-energy facility by the fourth invention is set to the third invention. Said cooling means for oxidation gas is controlled so that said control means cools said oxidation gas, when the load of said fuel cell is large. Since said cooling means for fuel gas is controlled to cool said fuel gas when the load of said fuel cell is small, even if it changes the load of a fuel cell rapidly, this can be followed and the humidity of oxidation gas and fuel gas can be adjusted.

[0032] The fuel cell generation-of-electrical-energy facility by the fifth invention is set to the third or the fourth invention. A temperature-and-humidity measurement means for supply oxidation gas to measure the temperature and humidity of said oxidation gas which are supplied to said fuel cell, It has a temperature-and-humidity measurement means for supply fuel gas to measure the temperature and humidity of said fuel gas which are supplied to said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for supply oxidation gas, and said temperature-and-humidity measurement means for supply fuel gas. said oxidation gas and said fuel gas are made into predetermined temperature and humidity -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water, since a steamy mixing means, said cooling means for oxidation gas, and said cooling means for fuel gas are controlled, respectively Oxidation gas and fuel gas can be adjusted to the temperature and humidity corresponding to the load of a fuel cell, without being influenced by the original temperature and humidity of oxidation gas and fuel gas.

[0033] The fuel cell generation-of-electrical-energy facility by the sixth invention is set to the fifth invention. A temperature-and-humidity measurement means for discharge oxidation gas to measure the temperature and humidity of said oxidation gas which were discharged from said fuel cell, It has a temperature-and-humidity measurement means for discharge fuel gas to measure the temperature and humidity of said fuel gas which were discharged from said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for discharge oxidation gas, and said temperature-and-humidity measurement means for discharge fuel gas. So that said oxidation gas by which it is discharged from said fuel cell, and said fuel gas may be made into predetermined temperature and humidity Said cooling means for oxidation gas, said cooling means for fuel gas, and said oxidization gas -- service water -- a steamy mixing means and said fuel gas -- service water, since feedback control of the steamy mixing means is carried out, respectively The humidity of oxidation gas and fuel gas can be adjusted checking condensation of the redundant water in passage Mizouchi of the oxidation gas of the separator of a fuel cell, or fuel gas, and the damp or wet

condition of the solid-state polyelectrolyte of a cel.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the fuel cell 100 which was mentioned above, while moisture moves to an oxidation gas pole side from a fuel gas pole side with migration of the hydrogen ion in the solid-state polyelectrolyte of the cel in a stack, water generates to an oxidation gas pole side with the reaction of the oxidation gas (oxygen) 1 by the side of the oxidation gas pole of a cel, and the above-mentioned hydrogen ion. Thus, although the moisture which moves to an oxidation gas pole side, and the moisture generated with the reaction will be used for humidification of a solid-state polyelectrolyte with the steam 3 mentioned above when the load of a fuel cell 100 is small (at the time of low loading), when the load of a fuel cell 100 is large (at the time of a heavy load), its amount of the will increase sharply and the amount of surplus will condense it by oxidation gas-passageway Mizouchi of a separator. Thus, if water condenses by oxidation gas-passageway Mizouchi of a separator, smooth circulation of oxidation gas 1 will be barred, the short supply of oxidation gas 1 will be caused, and a possibility of causing the fall of generation-of-electrical-energy capacity will be produced.
[0005] Since it is such, this invention aims at offering the fuel cell generation-of-electrical-energy facility which can suppress generating of redundant water, though a solid-state polyelectrolyte is always fully humidified.

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MEANS

[Means for Solving the Problem] The fuel cell generation-of-electrical-energy facility by the first invention for solving the technical problem mentioned above The fuel cell with which the cel and the separator were equipped with the stack by which two or more laminatings were carried out by turns, An oxidation gas supply means to supply oxidation gas to said fuel cell, and a fuel gas supply means to supply fuel gas to said fuel cell, the oxidation gas which mixes a steam in said oxidation gas supplied from said oxidation gas supply means -- service water -- with a steamy mixing means the fuel gas which mixes a steam to said fuel gas supplied from said fuel gas supply means -- service water -- with a steamy mixing means based on the signal of the loaded condition from said fuel cell, the amount of the steam mixed to said oxidation gas and said fuel gas is adjusted -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by having the control means which controls a steamy mixing means.
[0007] The fuel cell generation-of-electrical-energy facility by the second invention is set to the first invention. Said cooling means for fuel gas is controlled to increase the amount of the steam mixed to said fuel gas while said control means controls said cooling means for oxidation gas to reduce the amount of the steam mixed in said oxidation gas, when the load of said fuel cell is large. When the load of said fuel cell is small, while controlling said cooling means for oxidation gas to increase the amount of the steam mixed in said oxidation gas, it is characterized by controlling said cooling means for fuel gas to reduce the amount of the steam mixed to said fuel gas.
[0008] The fuel cell generation-of-electrical-energy facility by the third invention is set to the first or the second invention. A cooling means for oxidation gas to adjust the moisture in the oxidation gas concerned by cooling said oxidation gas which had said steam mixed, It has a cooling means for fuel gas to adjust the moisture in the fuel gas concerned by cooling said fuel gas which had said steam mixed. Said control means is characterized by controlling said cooling means for oxidation gas, and said cooling means for fuel gas based on the signal of the loaded condition from said fuel cell to cool said oxidation gas and said fuel gas.
[0009] As for the fuel cell generation-of-electrical-energy facility by the fourth invention, it is characterized by for said control means controlling said cooling means for oxidation gas to cool said oxidation gas, when the load of said fuel cell is

large, and controlling said cooling means for fuel gas in the third invention, to cool said fuel gas, when the load of said fuel cell is small.

[0010] The fuel cell generation-of-electrical-energy facility by the fifth invention is set to the third or the fourth invention. A temperature-and-humidity measurement means for supply oxidation gas to measure the temperature and humidity of said oxidation gas which are supplied to said fuel cell, It has a temperature-and-humidity measurement means for supply fuel gas to measure the temperature and humidity of said fuel gas which are supplied to said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for supply oxidation gas, and said temperature-and-humidity measurement means for supply fuel gas. said oxidation gas and said fuel gas are made into predetermined temperature and humidity -- as -- said oxidation gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by controlling a steamy mixing means, said cooling means for oxidation gas, and said cooling means for fuel gas, respectively.

[0011] The fuel cell generation-of-electrical-energy facility by the sixth invention is set to the fifth invention. A temperature-and-humidity measurement means for discharge oxidation gas to measure the temperature and humidity of said oxidation gas which were discharged from said fuel cell, It has a temperature-and-humidity measurement means for discharge fuel gas to measure the temperature and humidity of said fuel gas which were discharged from said fuel cell. Said control means is based on a signal from said temperature-and-humidity measurement means for discharge oxidation gas, and said temperature-and-humidity measurement means for discharge fuel gas. So that said oxidation gas by which it is discharged from said fuel cell, and said fuel gas may be made into predetermined temperature and humidity Said cooling means for oxidation gas, said cooling means for fuel gas, and said oxidization gas -- service water -- a steamy mixing means and said fuel gas -- service water -- it is characterized by carrying out feedback control of the steamy mixing means, respectively.

[0012]

[Embodiment of the Invention] The gestalt of implementation of the fuel cell generation-of-electrical-energy facility by this invention is explained using drawing 1 . Drawing 1 is the outline block diagram of a fuel cell generation-of-electrical-energy facility. In addition, this invention is not limited to the gestalt of the following operations.

[0013] As shown in drawing 1 , the sources 101 of oxidation gas supply (for example, air compressor etc.) which are oxidation gas supply means to supply oxidation gas 1, such as air and oxygen, are connected to oxidation gas supply opening of the fuel cell 100 with which the cel which sandwiched the solid-state polyelectrolyte on the oxidation gas pole and the fuel gas pole, and the separator were equipped with the stack by which two or more laminatings were carried out by turns. The fuel gas sources of supply (for example, methanol-reforming machine etc.) 102 which are fuel gas supply means to supply fuel gas 2, such as hydrogen gas, are connected to the fuel gas feed hopper of a fuel cell 100.

[0014] Between said sources 101 of oxidation gas supply and said oxidation gas supply openings of a fuel cell 100, the steam generator 10 made to generate a

steam 3 is connected through mixer 11a. Between said fuel gas sources of supply 102 and said fuel gas feed hoppers of a fuel cell 100, the above-mentioned steam generator 10 is connected through mixer 11b. Between said mixer 11a and said oxidation gas supply openings of a fuel cell 100, the cooling water feeding machine 20 which feeds cooling water 4 is connected through condenser 21a. Between said mixer 11b and said fuel gas feed hoppers of a fuel cell 100, the above-mentioned cooling water feeding machine 20 is connected through condenser 21b.
[0015] in addition -- the gestalt of this operation -- the steam generator 10, mixer 11a, etc. -- oxidation gas -- service water -- a steamy mixing means -- constituting -- the steam generator 10, mixer 11b, etc. -- fuel gas -- service water -- a steamy mixing means is constituted, the cooling water feeding machine 20, condenser 21a, etc. constitute the cooling means for oxidation gas, and the cooling water feeding machine 20, condenser 21b, etc. constitute the cooling means for fuel gas.
[0016] Said steam generator 10 and said cooling water feeding machine 20 are electrically connected to the output section of the control unit 40 which is a control means, respectively. On the other hand, between said condenser 21a and said oxidation gas supply openings of a fuel cell 100, temperature-and-humidity sensor 30a which is a temperature-and-humidity measurement means for supply oxidation gas to detect temperature and humidity is prepared. Between said condenser 21b and said fuel gas feed hoppers of a fuel cell 100, temperature-and-humidity sensor 30b which is a temperature-and-humidity measurement means for supply fuel gas to detect temperature and humidity is prepared. Near the oxidation gas exhaust of a fuel cell 100, temperature-and-humidity sensor 31a which is a temperature-and-humidity measurement means for discharge oxidation gas to detect temperature and humidity is prepared. Near the fuel gas exhaust port of a fuel cell 100, temperature-and-humidity sensor 31b which is a temperature-and-humidity measurement means for discharge fuel gas to detect temperature and humidity is prepared. These temperature-and-humidity sensors 30a, 30b, 31a, and 31b are electrically connected to the input section of the above-mentioned control unit 40, respectively. Moreover, the signal of loaded condition is inputted into the input section of the above-mentioned control unit 40 from a fuel cell 100.
[0017] Thus, it sets to the generation-of-electrical-energy facility constituted. While the oxidation gas 1 fed from the source 101 of oxidation gas supply is supplied to oxidation gas supply opening of a fuel cell 100 If the fuel gas 2 fed from the fuel gas source of supply 102 is supplied to the fuel gas feed hopper of a fuel cell 100 The oxidation gas pole of each cel is supplied from the oxidation gas-passageway slot where oxidation gas 1 was formed in one field of each separator of a stack. The fuel gas pole of each cel is supplied from the fuel gas passage slot where fuel gas 2 was formed in the field of another side of each separator of a stack, the oxidation gas (oxygen) concerned and fuel gas (hydrogen) react electrochemically in a cel from it, and a generation of electrical energy is performed.
[0018] In order to fully carry out humidity of the solid-state polyelectrolyte of each cel in the stack of a fuel cell 100 at this time, By generating a steam 3 by the steam generator 10, and feeding in mixer 11a and 11b A steam 3 is mixed to

oxidation gas 1 and fuel gas 2, and moisture is supplied to the solid-state polyelectrolyte of each cel in a stack by supplying a steam 3 in the stack of a fuel cell 100 with oxidation gas 1 and fuel gas 2, respectively.

[0019] Thus, if the load of a fuel cell 100 becomes large when generating electricity The amount of the moisture generated to the oxidation gas pole side accompanying the reaction of the oxidation gas (oxygen) 1 by the side of [the fuel gas pole side accompanying migration of the hydrogen ion in the solid-state polyelectrolyte of the cel in a stack to] the movement magnitude of the moisture by the side of an oxidation gas pole and the oxidation gas pole of a cel and the above-mentioned hydrogen ion increases sharply. Redundant water is produced in an oxidation gas pole side, and a possibility that the redundant water concerned may condense by oxidation gas-passageway Mizouchi of a separator, and may bar smooth circulation of oxidation gas 1 is produced.

[0020] Then, in a fuel cell generation-of-electrical-energy facility of the gestalt of this operation, said control unit 40 controls the steam generator 10 and the cooling water feeding machine 20 based on the signal of the loaded condition from a fuel cell 100, and the signal from said temperature-and-humidity sensors 30a, 30b, 31a, and 31b to fully carry out humidity of the solid-state polyelectrolyte of a cel, without making redundant water condense by oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100. The control approach by this control unit 40 is explained below using drawing 2 and 3. The graph with which drawing 2 expresses relation with the humidity of the electrical property of a fuel cell, oxidation gas, and fuel gas, and drawing 3 are the graphs showing the humidity of the oxidation gas accompanying a load effect, and fuel gas.

[0021] A fuel cell 100 has few amounts of the moisture generated to a movement magnitude [of the moisture from an above-mentioned fuel gas pole side to an oxidation gas pole side], and oxidation gas pole side at the time of the small low loading of a load, and the amount of the moisture generated to a movement magnitude [of the moisture from an above-mentioned fuel gas pole side to an oxidation gas pole side] and oxidation gas pole side at the time of the large heavy load of a load increases. As shown in drawing 2 , for this reason, at the time of the low loading of a fuel cell 100 (inside of drawing 2 , left (for example, A point)) the humidity of oxidation gas 1 -- comparatively -- many -- carrying out (80%) -- humidity of fuel gas 2 is lessened comparatively (70%) -- on the other hand at the time of the heavy load of a fuel cell 100 (inside of drawing 2 , rightist inclinations (for example, B point)) the humidity of oxidation gas 1 -- comparatively -- few -- carrying out (20%) -- humidity of fuel gas 2 is made [many / comparatively] (90%) -- ** -- by carrying out Humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100 condense redundant water.

[0022] That is, humidity of the solid-state polyelectrolyte of a cel can fully be carried out, without making redundant water flow into oxidation gas-passageway Mizouchi of the separator in the stack of a fuel cell 100 by adjusting the humidity of oxidation gas 1 and fuel gas 2 so that it may correspond to the graph shown in drawing 2 based on the loaded condition of a fuel cell 100.

[0023] A control unit 40 is specifically based on the signal of the loaded condition

of a fuel cell 100, and a signal from the temperature-and-humidity sensors 30a and 30b. While adjusting the amount of the steam 3 which controls the steam generator 10 to make it in agreement with the value of the graph which showed the humidity of the oxidation gas 1 supplied in a fuel cell 100, and fuel gas 2 to drawing 2 , and is mixed to oxidation gas 1 and fuel gas 2 Humidity of the oxidation gas 1 accompanying change of the moisture by the side of the above-mentioned oxidation gas pole produced in the cel in the stack of a fuel cell 100 and a fuel gas pole and fuel gas 2 is checked with the signal from the temperature-and-humidity sensors 31a and 31b (feedback).

[0024] When the load of a fuel cell 100 increases rapidly, here A control unit 40 controls the yield of the steam 3 from the steam generator 10 to make humidity of oxidation gas 1 low quickly, while making humidity of fuel gas 2 high quickly. When the loads of a fuel cell 100 decrease in number rapidly, a control unit 40 needs to control the yield of the steam 3 from the steam generator 10 to make humidity of fuel gas 2 low quickly while making humidity of oxidation gas 1 high quickly. Although controlled to remove a part for needlessness with Condensers 21a and 21b superfluously [amount / of the steam 3 generated from the steam generator 10], making high quickly humidity of oxidation gas 1 or fuel gas 2 by adjusting the amount of the steam 3 generated from the steam generator 10 It is very difficult to make low quickly humidity of oxidation gas 1 or fuel gas 2 only by adjusting the amount of the steam 3 generated from the steam generator 10.

[0025] for this reason, further, when the load of a fuel cell 100 increases rapidly based on the signal of the loaded condition of a fuel cell 100, a control unit 40 By controlling the cooling water feeding machine 20 to make cooling water 4 spray into condenser 21a from the cooling water feeding machine 20 Oxidation gas 1 is cooled quickly, condensation removal of the moisture in the oxidation gas 1 concerned is carried out, and it is made quickly in agreement with the value of the graph which showed the humidity of the oxidation gas 1 supplied in a fuel cell 100 to drawing 2 . When the loads of a fuel cell 100 decrease in number rapidly like this, fuel gas 2 is quickly cooled by controlling the cooling water feeding machine 20, condensation removal of the moisture in the fuel gas 2 concerned is carried out so that cooling water 4 may be made to spray into condenser 21b, and it is made quickly in agreement with the value of the graph which showed the humidity of the fuel gas 2 supplied in a fuel cell 100 to drawing 2 .

[0026] Although both oxidation gas 1 and fuel gas 2 always had conventionally fixed humidity as shown in drawing 3 , by this with the gestalt of this operation When the load of a fuel cell 100 increases rapidly When the humidity of fuel gas 2 goes up with sufficient responsibility and the loads of a fuel cell 100 decrease in number rapidly at the same time it follows this and the humidity of oxidation gas 1 falls with sufficient responsibility This is followed, and the humidity of fuel gas 2 comes to fall with sufficient responsibility at the same time the humidity of oxidation gas 1 goes up with sufficient responsibility.

[0027] Therefore, according to the gestalt of this operation, though the solid-state polyelectrolyte of the cel in a stack is always fully humidified, generating of redundant water can be suppressed.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram of the gestalt of implementation of the fuel cell generation-of-electrical-energy facility by this invention.
[Drawing 2] It is a graph showing relation with the humidity of the electrical property of a fuel cell, oxidation gas, and fuel gas.
[Drawing 3] It is a graph showing the humidity of the oxidation gas accompanying the load effect of a fuel cell, and fuel gas.
[Drawing 4] It is the outline block diagram of an example of the conventional fuel cell generation-of-electrical-energy facility.
[Description of Notations]
1 Oxidation Gas
2 Fuel Gas
3 Steam
4 Cooling Water
10 Steam Generator
11a, 11b Gaseous mixture
20 Cooling Water Feeding Machine
21a, 21b Condenser
30a, 30b, 31a, 31b Temperature-and-humidity sensor
40 Control Unit
100 Fuel Cell
101 Source of Oxidation Gas Supply
102 Fuel Gas Source of Supply

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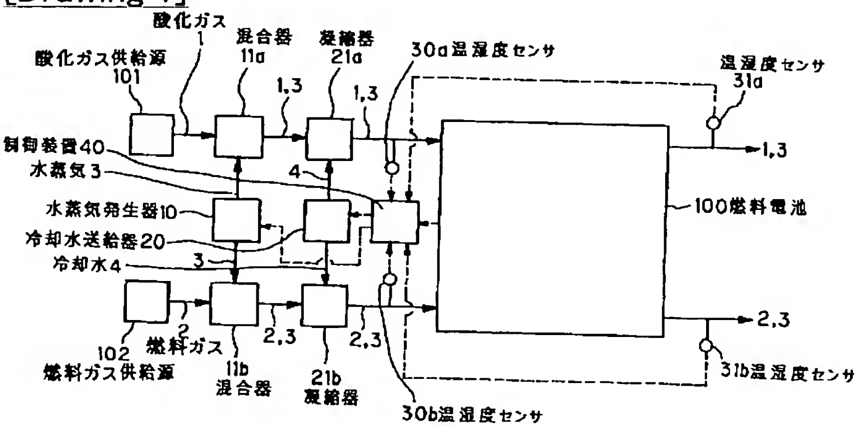
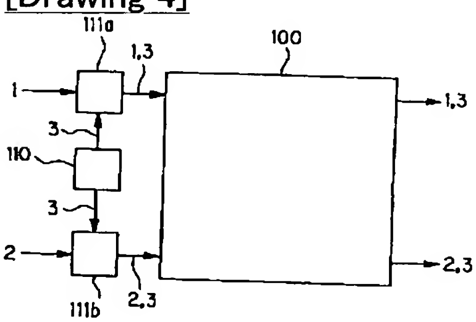
DRAWINGS

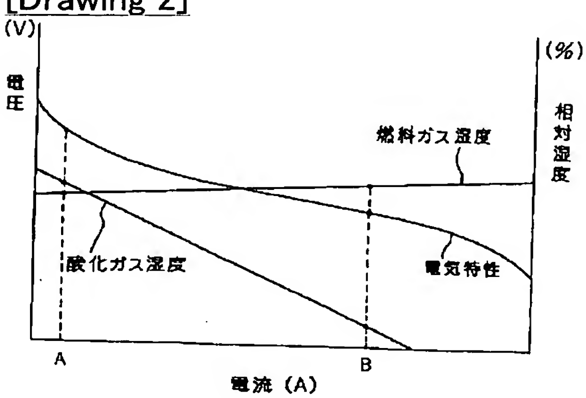
[Drawing 1]



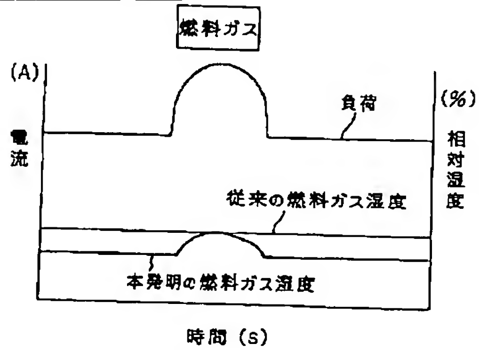
[Drawing 4]



[Drawing 2]



[Drawing 3]



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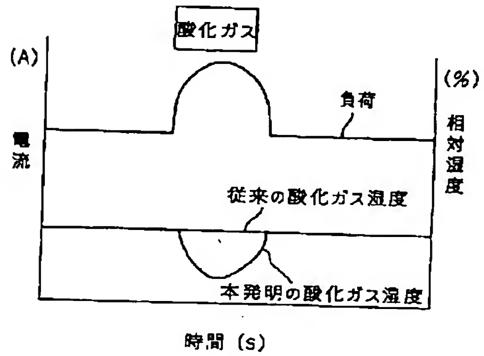

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審査請求　未請求　請求項の数６　ＯＬ　（全　７　頁）

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(71)出願人　000006208
三菱重工業株式会社
東京都千代田区丸の内二丁目５番１号

(72)発明者　戸田　正樹
神奈川県相模原市田名3000番地　三菱重工業株式会社汎用機・特車事業本部内

(72)発明者　峰尾　徳一
神奈川県相模原市田名3000番地　三菱重工業株式会社汎用機・特車事業本部内

(74)代理人　100078499
弁理士　光石　俊郎　（外２名）

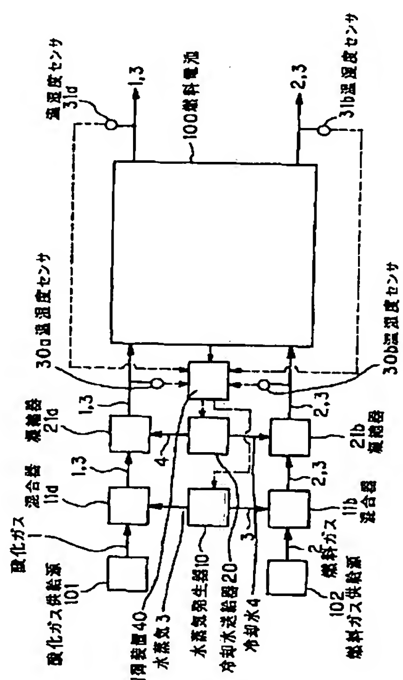
最終頁に続く

(54)【発明の名称】　燃料電池発電設備

(57)【要約】

【課題】　固体高分子電解質を常に十分に加湿しながらも余剰水の発生を抑えることができる燃料電池発電設備を提供する。

【解決手段】　セルとセパレータとが交互に複数積層されたスタックを備えた燃料電池１００と、空気供給源１０１および水素供給源１０２から供給された空気１および水素２に水蒸気３を混合する水蒸気発生器１０および混合気１１ａ，１１ｂと、水蒸気３を混合された空気１および水素２を冷却することにより空気１および水素２中の水分を調整する冷却水送給器２０および凝縮器２１ａ，２１ｂと、燃料電池１００からの負荷状態の信号および温湿度センサ３０ａ，３０ｂ，３１ａ，３１ｂからの信号に基づいて、水蒸気発生器１０および冷却水送給器２０を制御する制御手段４０とを備えた。



【特許請求の範囲】
【請求項１】　セルとセパレータとが交互に複数積層されたスタックを備えた燃料電池と、
前記燃料電池に酸化ガスを供給する酸化ガス供給手段と、
前記燃料電池に燃料ガスを供給する燃料ガス供給手段と、
前記酸化ガス供給手段から供給された前記酸化ガスに水蒸気を混合する酸化ガス用水蒸気混合手段と、
前記燃料ガス供給手段から供給された前記燃料ガスに水蒸気を混合する燃料ガス用水蒸気混合手段と、
前記燃料電池からの負荷状態の信号に基づいて、前記酸化ガスおよび前記燃料ガスに混合する水蒸気の量を調整するように前記酸化ガス用水蒸気混合手段および前記燃料ガス用水蒸気混合手段を制御する制御手段とを備えたことを特徴とする燃料電池発電設備。
【請求項２】　請求項１において、
前記制御手段が、
前記燃料電池の負荷が大きいときには前記酸化ガスに混合する水蒸気の量を減らすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を増やすように前記燃料ガス用冷却手段を制御し、
前記燃料電池の負荷が小さいときには前記酸化ガスに混合する水蒸気の量を増やすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を減らすように前記燃料ガス用冷却手段を制御することを特徴とする燃料電池発電設備。
【請求項３】　請求項１または２において、
前記水蒸気を混合された前記酸化ガスを冷却することにより当該酸化ガス中の水分を調整する酸化ガス用冷却手段と、
前記水蒸気を混合された前記燃料ガスを冷却することにより当該燃料ガス中の水分を調整する燃料ガス用冷却手段とを備え、
前記制御手段が、前記燃料電池からの負荷状態の信号に基づいて、前記酸化ガスおよび前記燃料ガスを冷却するように前記酸化ガス用冷却手段および前記燃料ガス用冷却手段を制御することを特徴とする燃料電池発電設備。
【請求項４】　請求項３において、
前記制御手段が、
前記燃料電池の負荷が大きいときには前記酸化ガスを冷却するように前記酸化ガス用冷却手段を制御し、
前記燃料電池の負荷が小さいときには前記燃料ガスを冷却するように前記燃料ガス用冷却手段を制御することを特徴とする燃料電池発電設備。
【請求項５】　請求項３または４において、
前記燃料電池に供給される前記酸化ガスの温度および湿度を計測する供給酸化ガス用温湿度計測手段と、
前記燃料電池に供給される前記燃料ガスの温度および湿度を計測する供給燃料ガス用温湿度計測手段とを備え、
前記制御手段が、前記供給酸化ガス用温湿度計測手段および前記供給燃料ガス用温湿度計測手段からの信号に基づいて、前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段、前記酸化ガス用冷却手段、前記燃料ガス用冷却手段をそれぞれ制御することを特徴とする燃料電池発電設備。
【請求項６】　請求項５において、
前記燃料電池から排出された前記酸化ガスの温度および湿度を計測する排出酸化ガス用温湿度計測手段と、
前記燃料電池から排出された前記燃料ガスの温度および湿度を計測する排出燃料ガス用温湿度計測手段とを備え、
前記制御手段が、前記排出酸化ガス用温湿度計測手段および前記排出燃料ガス用温湿度計測手段からの信号に基づいて、前記燃料電池から排出される前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用冷却手段、前記燃料ガス用冷却手段、前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段をそれぞれフィードバック制御することを特徴とする燃料電池発電設備。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、燃料電池発電設備に関する。
【０００２】
【従来の技術】固体高分子電解質型燃料電池は、固体高分子電解質を酸化ガス極および燃料ガス極で挟んだセルとセパレータとが交互に複数積層されたスタックを備え、当該スタック内に酸化ガスおよび燃料ガスが送給されると、酸化ガスが各セパレータの一方の面に形成された酸化ガス流路溝から各セルの酸化ガス極に供給され、燃料ガスが各セパレータの他方の面に形成された燃料ガス流路溝から各セルの燃料ガス極に供給され、当該酸化ガス（酸素）と燃料ガス（水素）とがセルにおいて電気化学的に反応することにより、電力が得られるようになっている。
【０００３】このような燃料電池においては、発電の際に、スタック内の各セルの固体高分子電解質が水素イオンの移動を可能とするために十分に湿潤している必要がある。このため、図４に示すように、燃料電池１００の酸化ガス供給口および燃料ガス供給口に混合器１１１ａ，１１１ｂを介して水蒸気発生器１１０を接続し、水蒸気発生器１１０で発生させた水蒸気３を混合器１１１ａ，１１１ｂで酸化ガス１および燃料ガス２に混合し、酸化ガス１および燃料ガス２と共に水蒸気３を燃料電池１００内にそれぞれ供給することにより、スタック内の各セルの固体高分子電解質に水分を供給するようにしている。すなわち、発電の原料として使用する酸化ガス１および燃料ガス２を水蒸気３のキャリアガスとして利用

するようにしているのである。

【０００４】

【発明が解決しようとする課題】前述したような燃料電池１００においては、スタック内のセルの固体高分子電解質における水素イオンの移動に伴って、燃料ガス極側から酸化ガス極側へ水分が移動すると共に、セルの酸化ガス極側での酸化ガス（酸素）１と上記水素イオンとの反応に伴って、酸化ガス極側に水が生成する。このように酸化ガス極側に移動してくる水分や反応に伴って生成した水分は、燃料電池１００の負荷が小さいとき（低負荷時）には、上述した水蒸気３と共に固体高分子電解質の加湿に使用されてしまうものの、燃料電池１００の負荷が大きいとき（高負荷時）には、その量が大幅に増えてしまい、余剰分がセパレータの酸化ガス流路溝内で凝縮してしまう。このようにセパレータの酸化ガス流路溝内で水が凝縮してしまうと、酸化ガス１のスムーズな流通を妨げてしまい、酸化ガス１の供給不足を招き、発電能力の低下を引き起こす虞を生じてしまう。

【０００５】このようなことから、本発明は、固体高分子電解質を常に十分に加湿しながらも余剰水の発生を抑えることができる燃料電池発電設備を提供することを目的とする。

【０００６】

【課題を解決するための手段】前述した課題を解決するための、第一番目の発明による燃料電池発電設備は、セルとセパレータとが交互に複数積層されたスタックを備えた燃料電池と、前記燃料電池に酸化ガスを供給する酸化ガス供給手段と、前記燃料電池に燃料ガスを供給する燃料ガス供給手段と、前記酸化ガス供給手段から供給された前記酸化ガスに水蒸気を混合する酸化ガス用水蒸気混合手段と、前記燃料ガス供給手段から供給された前記燃料ガスに水蒸気を混合する燃料ガス用水蒸気混合手段と、前記燃料電池からの負荷状態の信号に基づいて、前記酸化ガスおよび前記燃料ガスに混合する水蒸気の量を調整するように前記酸化ガス用水蒸気混合手段および前記燃料ガス用水蒸気混合手段を制御する制御手段とを備えたことを特徴とする。

【０００７】第二番目の発明による燃料電池発電設備は、第一番目の発明において、前記制御手段が、前記燃料電池の負荷が大きいときには前記酸化ガスに混合する水蒸気の量を減らすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を増やすように前記燃料ガス用冷却手段を制御し、前記燃料電池の負荷が小さいときには前記酸化ガスに混合する水蒸気の量を増やすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を減らすように前記燃料ガス用冷却手段を制御することを特徴とする。

【０００８】第三番目の発明による燃料電池発電設備は、第一番目または第二番目の発明において、前記水蒸気を混合された前記酸化ガスを冷却することにより当該酸化ガス中の水分を調整する酸化ガス用冷却手段と、前記水蒸気を混合された前記燃料ガスを冷却することにより当該燃料ガス中の水分を調整する燃料ガス用冷却手段とを備え、前記制御手段が、前記燃料電池からの負荷状態の信号に基づいて、前記酸化ガスおよび前記燃料ガスを冷却するように前記酸化ガス用冷却手段および前記燃料ガス用冷却手段を制御することを特徴とする。

【０００９】第四番目の発明による燃料電池発電設備は、第三番目の発明において、前記制御手段が、前記燃料電池の負荷が大きいときには前記酸化ガスを冷却するように前記酸化ガス用冷却手段を制御し、前記燃料電池の負荷が小さいときには前記燃料ガスを冷却するように前記燃料ガス用冷却手段を制御することを特徴とする。

【００１０】第五番目の発明による燃料電池発電設備は、第三番目または第四番目の発明において、前記燃料電池に供給される前記酸化ガスの温度および湿度を計測する供給酸化ガス用温湿度計測手段と、前記燃料電池に供給される前記燃料ガスの温度および湿度を計測する供給燃料ガス用温湿度計測手段とを備え、前記制御手段が、前記供給酸化ガス用温湿度計測手段および前記供給燃料ガス用温湿度計測手段からの信号に基づいて、前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段、前記酸化ガス用冷却手段、前記燃料ガス用冷却手段をそれぞれ制御することを特徴とする。

【００１１】第六番目の発明による燃料電池発電設備は、第五番目の発明において、前記燃料電池から排出された前記酸化ガスの温度および湿度を計測する排出酸化ガス用温湿度計測手段と、前記燃料電池から排出された前記燃料ガスの温度および湿度を計測する排出燃料ガス用温湿度計測手段とを備え、前記制御手段が、前記排出酸化ガス用温湿度計測手段および前記排出燃料ガス用温湿度計測手段からの信号に基づいて、前記燃料電池から排出される前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用冷却手段、前記燃料ガス用冷却手段、前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段をそれぞれフィードバック制御することを特徴とする。

【００１２】

【発明の実施の形態】本発明による燃料電池発電設備の実施の形態を図１を用いて説明する。図１は、燃料電池発電設備の概略構成図である。なお、本発明は、以下の実施の形態に限定されるものではない。

【００１３】図１に示すように、固体高分子電解質を酸化ガス極および燃料ガス極で挟んだセルとセパレータとが交互に複数積層されたスタックを備えた燃料電池１００の酸化ガス供給口には、空気や酸素などのような酸化ガス１を供給する酸化ガス供給手段である酸化ガス供給

源（例えば、エアコンプレッサ等）１０１が接続されている。燃料電池１００の燃料ガス供給口には、水素ガスなどのような燃料ガス２を供給する燃料ガス供給手段である燃料ガス供給源（例えば、メタノール改質器等）１０２が接続されている。

【００１４】前記酸化ガス供給源１０１と燃料電池１００の前記酸化ガス供給口との間には、水蒸気３を発生させる水蒸気発生器１０が混合器１１ａを介して連結されている。前記燃料ガス供給源１０２と燃料電池１００の前記燃料ガス供給口との間には、上記水蒸気発生器１０が混合器１１ｂを介して連結されている。前記混合器１１ａと燃料電池１００の前記酸化ガス供給口との間には、冷却水４を送給する冷却水送給器２０が凝縮器２１ａを介して連結されている。前記混合器１１ｂと燃料電池１００の前記燃料ガス供給口との間には、上記冷却水送給器２０が凝縮器２１ｂを介して連結されている。

【００１５】なお、本実施の形態では、水蒸気発生器１０、混合器１１ａなどにより酸化ガス用水蒸気混合手段を構成し、水蒸気発生器１０、混合器１１ｂなどにより燃料ガス用水蒸気混合手段を構成し、冷却水送給器２０、凝縮器２１ａなどにより酸化ガス用冷却手段を構成し、冷却水送給器２０、凝縮器２１ｂなどにより燃料ガス用冷却手段を構成している。

【００１６】前記水蒸気発生器１０および前記冷却水送給器２０は、制御手段である制御装置４０の出力部にそれぞれ電気的に接続している。一方、前記凝縮器２１ａと燃料電池１００の前記酸化ガス供給口との間には、温度および湿度を検知する供給酸化ガス用温湿度計測手段である温湿度センサ３０ａが設けられている。前記凝縮器２１ｂと燃料電池１００の前記燃料ガス供給口との間には、温度および湿度を検知する供給燃料ガス用温湿度計測手段である温湿度センサ３０ｂが設けられている。燃料電池１００の酸化ガス排出口近傍には、温度および湿度を検知する排出酸化ガス用温湿度計測手段である温湿度センサ３１ａが設けられている。燃料電池１００の燃料ガス排出口近傍には、温度および湿度を検知する排出燃料ガス用温湿度計測手段である温湿度センサ３１ｂが設けられている。これら温湿度センサ３０ａ，３０ｂ，３１ａ，３１ｂは、上記制御装置４０の入力部にそれぞれ電気的に接続されている。また、上記制御装置４０の入力部には、燃料電池１００から負荷状態の信号が入力されるようになっている。

【００１７】このようにして構成される発電設備においては、酸化ガス供給源１０１から送給された酸化ガス１が燃料電池１００の酸化ガス供給口に供給されると共に、燃料ガス供給源１０２から送給された燃料ガス２が燃料電池１００の燃料ガス供給口に供給されると、酸化ガス１がスタックの各セパレータの一方の面に形成された酸化ガス流路溝から各セルの酸化ガス極に供給され、燃料ガス２がスタックの各セパレータの他方の面に形成された燃料ガス流路溝から各セルの燃料ガス極に供給され、当該酸化ガス（酸素）と燃料ガス（水素）とがセルにおいて電気化学的に反応して、発電が行われる。

【００１８】このとき、燃料電池１００のスタック内の各セルの固体高分子電解質を十分に湿潤させておく必要があるため、水蒸気発生器１０で水蒸気３を発生させて混合器１１ａ，１１ｂ内に送給することにより、酸化ガス１および燃料ガス２に水蒸気３を混合し、酸化ガス１および燃料ガス２と共に水蒸気３を燃料電池１００のスタック内にそれぞれ供給することでスタック内の各セルの固体高分子電解質に水分を供給する。

【００１９】このようにして発電を行っている際に、燃料電池１００の負荷が大きくなると、スタック内のセルの固体高分子電解質における水素イオンの移動に伴う燃料ガス極側から酸化ガス極側への水分の移動量およびセルの酸化ガス極側での酸化ガス（酸素）１と上記水素イオンとの反応に伴う酸化ガス極側に生成する水分の量が大幅に増え、酸化ガス極側に余剰水を生じてしまい、当該余剰水がセパレータの酸化ガス流路溝内で凝縮して酸化ガス１のスムーズな流通を妨げる虞を生じる。

【００２０】そこで、本実施の形態の燃料電池発電設備においては、前記制御装置４０が、燃料電池１００のスタック内のセパレータの酸化ガス流路溝内で余剰水を凝縮させることなくセルの固体高分子電解質を十分に湿潤させるように、燃料電池１００からの負荷状態の信号および前記温湿度センサ３０ａ，３０ｂ，３１ａ，３１ｂからの信号に基づいて、水蒸気発生器１０および冷却水送給器２０を制御するのである。この制御装置４０による制御方法を図２，３を用いて以下に説明する。図２は、燃料電池の電気特性と酸化ガスおよび燃料ガスの湿度との関係を表すグラフ、図３は、負荷変動に伴う酸化ガスおよび燃料ガスの湿度変化を表すグラフである。

【００２１】燃料電池１００は、負荷の小さい低負荷時においては、上述の燃料ガス極側から酸化ガス極側への水分の移動量および酸化ガス極側に生成する水分の量が少なく、負荷の大きい高負荷時においては、上述の燃料ガス極側から酸化ガス極側への水分の移動量および酸化ガス極側に生成する水分の量が多くなる。このため、図２に示すように、燃料電池１００の低負荷時（図２中、左寄り（例えばＡ点））には、酸化ガス１の湿度を比較的多くする（８０％）と共に、燃料ガス２の湿度を比較的少なくする（７０％）一方、燃料電池１００の高負荷時（図２中、右寄り（例えばＢ点））には、酸化ガス１の湿度を比較的少なくする（２０％）と共に、燃料ガス２の湿度を比較的多くする（９０％）とすることにより、燃料電池１００のスタック内のセパレータの酸化ガス流路溝内に余剰水を凝縮させることなくセルの固体高分子電解質を十分に湿潤させることができるようになる。

【００２２】すなわち、燃料電池１００の負荷状態に基

づいて、図２に示したグラフに対応するように酸化ガス１および燃料ガス２の湿度を調整することにより、燃料電池１００のスタック内のセパレータの酸化ガス流路溝内に余剰水を流入させることなくセルの固体高分子電解質を十分に湿潤させることができるのである。

【００２３】具体的には、制御装置４０は、燃料電池１００の負荷状態の信号および温湿度センサ３０ａ，３０ｂからの信号に基づいて、燃料電池１００内に供給する酸化ガス１および燃料ガス２の湿度を図２に示したグラフの値と一致させるように水蒸気発生器１０を制御して、酸化ガス１および燃料ガス２に混合する水蒸気３の量を調整すると共に、燃料電池１００のスタック内のセルで生じる上述の酸化ガス極側と燃料ガス極側との水分の変化に伴う酸化ガス１および燃料ガス２の湿度変化を温湿度センサ３１ａ，３１ｂからの信号により確認（フィードバック）するのである。

【００２４】ここで、例えば、燃料電池１００の負荷が急激に増加したときには、制御装置４０は、燃料ガス２の湿度を急速に高くすると共に酸化ガス１の湿度を急速に低くするように水蒸気発生器１０からの水蒸気３の発生量を制御し、燃料電池１００の負荷が急激に減少したときには、制御装置４０は、酸化ガス１の湿度を急速に高くすると共に燃料ガス２の湿度を急速に低くするように水蒸気発生器１０からの水蒸気３の発生量を制御する必要がある。水蒸気発生器１０から発生する水蒸気３の量を調整することで酸化ガス１や燃料ガス２の湿度を急速に高くすることは、水蒸気発生器１０から発生する水蒸気３の量を過剰に加えて、凝縮器２１ａ，２１ｂで不要分を取り除くように制御するが、水蒸気発生器１０から発生する水蒸気３の量を調整することだけで酸化ガス１や燃料ガス２の湿度を急速に低くすることは非常に難しい。

【００２５】このため、制御装置４０は、さらに、燃料電池１００の負荷状態の信号に基づいて、燃料電池１００の負荷が急激に増加したときには、冷却水送給器２０から凝縮器２１ａ内に冷却水４を噴霧させるように冷却水送給器２０を制御することにより、酸化ガス１を急速に冷却して当該酸化ガス１中の水分を凝縮除去して、燃料電池１００内に供給する酸化ガス１の湿度を図２に示したグラフの値と急速に一致させるのである。これと同様に、燃料電池１００の負荷が急激に減少したときには、凝縮器２１ｂ内に冷却水４を噴霧させるように冷却水送給器２０を制御することにより、燃料ガス２を急速に冷却して当該燃料ガス２中の水分を凝縮除去して、燃料電池１００内に供給する燃料ガス２の湿度を図２に示したグラフの値と急速に一致させる。

【００２６】これにより、例えば、図３に示すように、従来は酸化ガス１および燃料ガス２の両者共に湿度が常に一定であったものの、本実施の形態では、燃料電池１００の負荷が急激に増加するときには、これに追従して、酸化ガス１の湿度が応答性よく下がると同時に燃料ガス２の湿度が応答性よく上がり、燃料電池１００の負荷が急激に減少するときには、これに追従して、酸化ガス１の湿度が応答性よく上がると同時に燃料ガス２の湿度が応答性よく下がるようになる。

【００２７】したがって、本実施の形態によれば、スタック内のセルの固体高分子電解質を常に十分に加湿しながらも、余剰水の発生を抑えることができる。

【００２８】

【発明の効果】第一番目の発明による燃料電池発電設備は、セルとセパレータとが交互に複数積層されたスタックを備えた燃料電池と、前記燃料電池に酸化ガスを供給する酸化ガス供給手段と、前記燃料電池に燃料ガスを供給する燃料ガス供給手段と、前記酸化ガス供給手段から供給された前記酸化ガスに水蒸気を混合する酸化ガス用水蒸気混合手段と、前記燃料ガス供給手段から供給された前記燃料ガスに水蒸気を混合する燃料ガス用水蒸気混合手段と、前記燃料電池からの負荷状態の信号に基づいて、前記酸化ガスおよび前記燃料ガスに混合する水蒸気の量を調整するように前記酸化ガス用水蒸気混合手段および前記燃料ガス用水蒸気混合手段を制御する制御手段とを備えたことから、制御手段が燃料電池からの負荷状態の信号に基づいて酸化ガス用水蒸気混合手段および燃料ガス用水蒸気混合手段を制御して、酸化ガスおよび前記燃料ガスに混合する水蒸気の量を調整するので、燃料電池の負荷が変動しても、燃料電池のセパレータの酸化ガスや燃料ガスの流路溝内で余剰水を凝縮させることなくセルの固体高分子電解質を十分に湿潤させることができる。

【００２９】第二番目の発明による燃料電池発電設備は、第一番目の発明において、前記制御手段が、前記燃料電池の負荷が大きいときには前記酸化ガスに混合する水蒸気の量を減らすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を増やすように前記燃料ガス用冷却手段を制御し、前記燃料電池の負荷が小さいときには前記酸化ガスに混合する水蒸気の量を増やすように前記酸化ガス用冷却手段を制御すると共に前記燃料ガスに混合する水蒸気の量を減らすように前記燃料ガス用冷却手段を制御するので、燃料電池の負荷が変動しても、燃料電池のセパレータの酸化ガスや燃料ガスの流路溝内で余剰水を凝縮させることなくセルの固体高分子電解質を十分に湿潤させることができる。

【００３０】第三番目の発明による燃料電池発電設備は、第一番目または第二番目の発明において、前記水蒸気を混合された前記酸化ガスを冷却することにより当該酸化ガス中の水分を調整する酸化ガス用冷却手段と、前記水蒸気を混合された前記燃料ガスを冷却することにより当該燃料ガス中の水分を調整する燃料ガス用冷却手段とを備え、前記制御手段が、前記燃料電池からの負荷状

態の信号に基づいて、前記酸化ガスおよび前記燃料ガスを冷却するように前記酸化ガス用冷却手段および前記燃料ガス用冷却手段を制御するので、燃料電池の負荷が急激に変動しても、これに追従して酸化ガスおよび燃料ガスの湿度を調整することができる。

【００３１】第四番目の発明による燃料電池発電設備は、第三番目の発明において、前記制御手段が、前記燃料電池の負荷が大きいときには前記酸化ガスを冷却するように前記酸化ガス用冷却手段を制御し、前記燃料電池の負荷が小さいときには前記燃料ガスを冷却するように前記燃料ガス用冷却手段を制御するので、燃料電池の負荷が急激に変動しても、これに追従して酸化ガスおよび燃料ガスの湿度を調整することができる。

【００３２】第五番目の発明による燃料電池発電設備は、第三番目または第四番目の発明において、前記燃料電池に供給される前記酸化ガスの温度および湿度を計測する供給酸化ガス用温湿度計測手段と、前記燃料電池に供給される前記燃料ガスの温度および湿度を計測する供給燃料ガス用温湿度計測手段とを備え、前記制御手段が、前記供給酸化ガス用温湿度計測手段および前記供給燃料ガス用温湿度計測手段からの信号に基づいて、前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段、前記酸化ガス用冷却手段、前記燃料ガス用冷却手段をそれぞれ制御するので、酸化ガスおよび燃料ガスの当初の温湿度に左右されることなく、燃料電池の負荷に対応した温湿度に酸化ガスおよび燃料ガスを調整することができる。

【００３３】第六番目の発明による燃料電池発電設備は、第五番目の発明において、前記燃料電池から排出された前記酸化ガスの温度および湿度を計測する排出酸化ガス用温湿度計測手段と、前記燃料電池から排出された前記燃料ガスの温度および湿度を計測する排出燃料ガス用温湿度計測手段とを備え、前記制御手段が、前記排出酸化ガス用温湿度計測手段および前記排出燃料ガス用温湿度計測手段からの信号に基づいて、前記燃料電池から排出される前記酸化ガスおよび前記燃料ガスを所定の温度および湿度にするように前記酸化ガス用冷却手段、前記燃料ガス用冷却手段、前記酸化ガス用水蒸気混合手段、前記燃料ガス用水蒸気混合手段をそれぞれフィードバック制御するので、燃料電池のセパレータの酸化ガスや燃料ガスの流路溝内での余剰水の凝縮や、セルの固体高分子電解質の湿潤状態を確認しながら酸化ガスおよび燃料ガスの湿度を調整することができる。

【図面の簡単な説明】

【図１】本発明による燃料電池発電設備の実施の形態の概略構成図である。

【図２】燃料電池の電気特性と酸化ガスおよび燃料ガスの湿度との関係を表すグラフである。

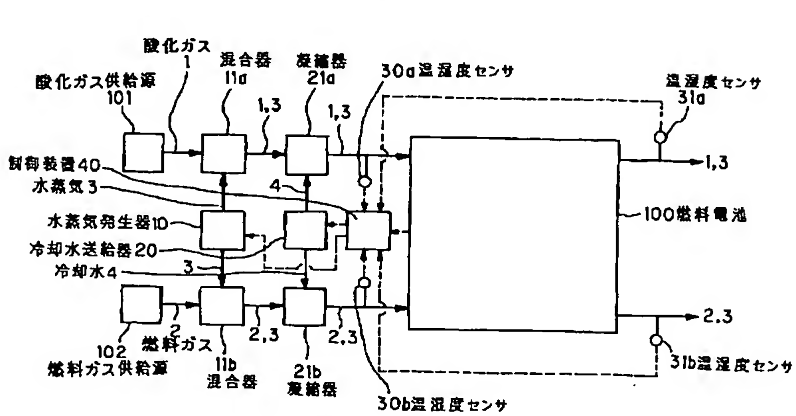
【図３】燃料電池の負荷変動に伴う酸化ガスおよび燃料ガスの湿度変化を表すグラフである。

【図４】従来の燃料電池発電設備の一例の概略構成図である。

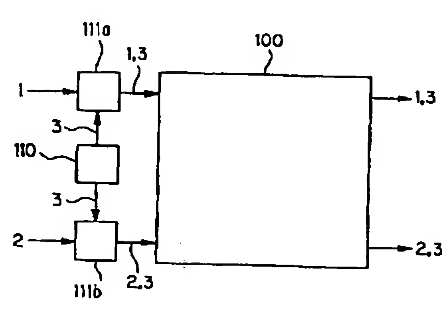
【符号の説明】

１　酸化ガス
２　燃料ガス
３　水蒸気
４　冷却水
１０　水蒸気発生器
１１ａ，１１ｂ　混合気
２０　冷却水送給器
２１ａ，２１ｂ　凝縮器
３０ａ，３０ｂ，３１ａ，３１ｂ　温湿度センサ
４０　制御装置
１００　燃料電池
１０１　酸化ガス供給源
１０２　燃料ガス供給源

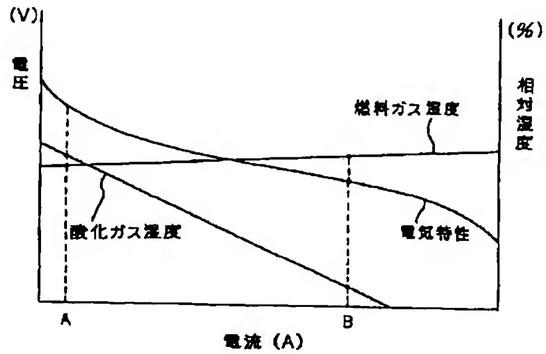
【図１】



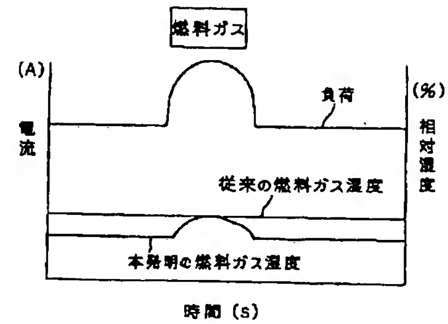
【図４】



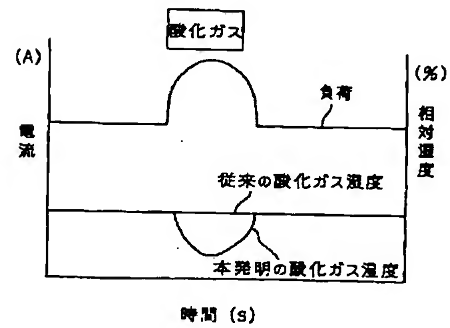
【図２】



【図３】



(a)



(b)

フロントページの続き

(72)発明者　小川　正毅
神奈川県相模原市田名3000番地　三菱重工業株式会社汎用機・特車事業本部内

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